New species of Uredineae—IX*

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In the interim of four years since the last group of species was published in this series a considerable number of forms have been separated which appear to be undescribed. Some of these forms have been recognized for a long time, such as *Puccinia Dondiae*, collected in 1882, *P. agnita* and *P. valida*, both collected in 1898, but as they have been known from single collections only, their previous publication has been withheld, hoping that more information would become available. The species are now issued to call the attention of collectors to them.

Four species of short-cycle forms are included in this group, *Uromyces abbreviatus* on *Psoralea*, *Puccinia tumamocensis* on *Dipterostemon*, *P. agnita* on *Claytonia* and *P. Fraseri* on *Hieracium*. These are especially interesting, as they are on common hosts bearing long-cycle species. The first two mentioned are closely correlated with more abundant long-cycle forms occupying the same region and the same hosts. Such forms are often overlooked in the too common way of naming collections without much regard to the life cycle. To the student interested in the phylogeny and classification of the rusts these short-cycle forms present a suggestive series of problems, and their recognition under distinctive names is highly important.

Uropyxis Wootoniana sp. nov.

O. Pycnia not seen.

II. Uredinia hypophyllous, numerous, scattered, rarely confluent, round to oblong, 0.5–1 mm. long, early naked, somewhat pulverulent, pulvinate, light cinnamon-brown; paraphyses absent; urediniospores terete-fusiform or ovate-fusiform, 13–19 by 35–45 μ; wall pale yellow or colorless, 2–4 μ thick, thicker at apex, 5–9 μ with hyaline umbo, finely and closely verrucose, the pores 8–12

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in two zones of 4–6 pores each, one above and one below the equator.

III. Telia hypophyllous, similar to the uredinia, chocolate-brown; teliospores broadly ellipsoid, 19–23 by 23–27 μ, rounded above and below, moderately constricted at septum; wall chestnut-brown, 3–5 μ thick, with longitudinal ridge-like, parallel striations, the pores lateral, indistinct; pedicel colorless, terete, 3–5 μ thick, 145–165 μ long, the wall thickened to obliterate the lumen except at the base.

On *Berberis haematocarpa* Wooton (*Odostemon haematocarpus* Heller), Organ Mountains, New Mexico, December 23, 1903, *3732;* Filmore Canyon, Organ Mountains, New Mexico, November 9, 1908 (type); Queen, Guadalupe Mountains, New Mexico, August 1, 1909, all by E. O. Wooton. I am pleased to have the opportunity to name this conspicuous and distinctive rust in honor of the able botanist who has been highly successful in making known the plants of New Mexico, and who not only supplied all the specimens of the rust so far seen, but also detected and described the host. The host is an evergreen shrub occurring on the mountain slopes in the southern part of New Mexico and Arizona.

Uromyces ornatipes sp. nov.

O. Pycnia not seen.

I. Aecia scattered about the slightly swollen but not discolored stem for 0.5–1 cm. in length, cylindric, 0.5–0.8 mm. high, with margin erect, erose or lacerate; peridial cells rhomboidal, 18–21 by 26–32 μ, overlapping, the outer wall smooth, 3–4 μ thick, the inner wall verrucose, 5–7 μ thick; aeciospores angularly globoid or ellipsoid, 18–23 by 24–27 μ; wall colorless, 1.5–2 μ thick, sometimes appearing thicker, very inconspicuously verrucose.

III. Telia among the aecia, seemingly arising from the aecial sori, round, 0.3–0.5 mm. in diameter, rising somewhat above surface of host, blackish brown; teliospores ellipsoid, 21–26 by 27–32 μ, rounded above and below; wall dark chocolate-brown, often opaque, 2–2.5 μ thick, thicker above, 5–7 μ, indistinctly striate; pedicel colorless, joined to the spore by a tinted collar, solid, 7–9 μ in diameter above, increasing to 10–13 μ in lower part, upper part smooth, lower part strongly rugose transversely.

Urediniospores not uncommon in the telial sori, ellipsoid, 21–24 by 26–33 μ; wall golden brown, 1.5–2.5 μ thick, sparsely verrucose, the pores equatorial, indistinct but probably 4.

On *Phrygilanthus Sonorae* (S. Wats.) Rose & Daniels (*Loranthus Sonorae* S. Wats.), Cape San Lucus, Lower California, Mexico, March, 1911, *J. N. Rose 16396*. In reference to the host Dr. Rose writes that no species of the true *Loranthus* has yet been found in America. The rust is a striking one. As no pycnia could be found, and the teliospores appear to arise from the same mycelium as the aecia, it seems probable that the aecia in this collection are the secondary form, and that the rust does not produce separate uredinia, but simply occasional urediniospores in the telial sori. The collection, although not ample, shows a fine development of the rust.

Uromyces abbreviatus sp. nov.

O. Pycnia hypophyllous, scattered among the telia, not numerous or conspicuous, subepidermal, in section globose, 130–150 μ in diameter.

III. Telia hypophyllous, scattered over large areas, round, 0.2–0.5 mm. across, early naked, pulverulent, chocolate-brown; teliospores ellipsoid or broadly obovoid, 20–23 by 24–37 μ, rounded at both ends, or somewhat narrowed below; wall chestnut-brown, uniformly thin, 3 μ, with a slight umbo over the pore, smooth; pedicel colorless, delicate, half as long as the spore, fugacious and appearing short.

On *Psoralea Purshii* Vail, Winnemucca, Nevada, July 1901, *Griffiths & Morris*, type (Griff. West Am. Fungi *390*); on *P. physodes* Dougl., Puget Sound Navy Yard, Bremeston, Washington, July 22, 1912, *E. Bartholomew 4752*. There is also an undated collection of this species in the Farlow Herbarium at Cambridge, Massachusetts, collected at Calistoga, California, by H. W. Harkness, on *P. physodes*. This species is the short-cycle form corresponding to *Uromyces Psoraleae* Peck. The aspect of the fungus in gross and microscopic characters is scarcely different from the corresponding spore-structures of the long-cycle form. In the specimens seen the telia are more numerous and highly pulverulent, making the fungus more conspicuous.

Puccinia Carnegiana sp. nov.

O. Pycnia amphigenous, in oval groups 1–2 mm. long, usually surrounded by aecia, or among them, subepidermal, globoid in section, about 200 μ in diameter; ostiolar filaments about 35 μ long.

I. Aecia amphigenous, in oval groups 1–4 mm. long on brownish spots, when mature falling away leaving the ruptured epidermis conspicuous; peridium delicate, deeply lacerate, recurved, the peridial cells lanceolate, rarely somewhat rhomboidal, pointed, 40–60 μ long, the outer wall 3–5 μ thick, smooth and transversely striate, the inner wall somewhat thinner, verrucose; aeciospores globoid, 23–27 by 24–34 μ; wall colorless, 2–3 μ thick, finely verrucose.

III. Telia amphigenous, scattered, often immediately outside or within the aecial cups, rather tardily naked by a longitudinal slit, blackish, slightly pulverulent; teliospores ellipsoid or oblong, 27–34 by 42–58 μ, slightly or not constricted at septum, usually rounded at both ends; wall blackish when mature, uniformly 2.5–3.5 μ thick, occasionally slightly thicker above, coarsely and prominently tuberculate; pedicel colorless, fragile, once length of spore or less.

Urediniospores in the telia rather common, broadly ellipsoid or obovoid, 27–35 by 32–42 μ; wall golden- or cinnamon-brown, about 1.5 μ thick, finely and moderately verrucose-echinulate, the pores 12–15, scattered.

On *Dipterostemon pauciflorus* (Torr.) Rydb. (*Brodiaea capitata pauciflora* Torr., *Dichelostemma pauciflorum* Standley), Tumamoc Hill, on grounds of the Desert Botanical Laboratory of the Carnegie Institution of Washington, Tucson, Arizona, altitude 2,700 feet, February 25, III, *5800*, February 26, O, I, III, *5801* type, February 26, O, I, *5802*, all by J. C. Arthur and F. D. Fromme; also March 12, III, by W. A. Cannon. The collections were made at different spots on Tumamoc Hill in vicinity of the Laboratory, and in the year 1914.

A part of *5802* was used for a culture made at the protected south side of the Laboratory building in the open, the resulting infection being watched and the matured sori transmitted by Dr. W. A. Cannon of the Laboratory staff. This culture is reported in Mycologia (7: 85. March, 1915), under the name *Puccinia nodosa*. A water culture was made of the urediniospores, which showed that they were capable of germination. Some aberration was observed in their behavior, but the stay at the Laboratory was too brief to obtain exact data, or to decide upon their significance. The urediniospores in a number of collections, kindly sent to Lafayette, Indiana, by Dr. Cannon, could not be made to germinate. The behavior of urediniospores has never

been studied in a species of this character, in which the sowing of aeciospores produces telia directly without the intervention of uredinia. It is probable that this is the first time that such spores have been seen to germinate. It is not known whether or not they are capable of infecting a plant and reproducing the rust.

Puccinia nodosa Ellis & Harkn., a species found on *Dipterostemon capitatus* (Benth.) Rydb. (*Brodiaea capitata* Benth.) from San Francisco to the southern part of California, differs from the one here proposed by having a definite uredinial stage with prominent sori. The hosts of the two species are similar, differing most strongly in the abundance of flowers in the umbels. *D. capitatus* is a Californian species, while *D. pauciflorus* ranges through southern Arizona into the border of New Mexico. *Puccinia nodosa* has not yet been cultured.

It was through the kindness and generous assistance of the director of the Desert Laboratory and of his staff of workers that the discovery of this rust and the brief but highly significant studies of it were made possible, and it is to acknowledge in part this aid to science that the first word in the title of the institution has been chosen for the specific name of the new species.

Puccinia tumamocensis sp. nov.

O. Pycnia hypophyllous in small groups surrounded by the telia, subepidermal, globoid as seen in section, 130–190 μ in diameter; ostiolar filaments 30–40 μ long.

III. Telia hypophyllous, closely placed in elliptical groups 3–10 mm. long surrounding the pycnia, elliptical, 1–2 mm. long, becoming naked by longitudinal rupture of the epidermis, pulverulent, blackish; teliospores broadly ellipsoid, 32–42 by 48–61 μ, slightly or not constricted at septum, rounded at both ends; wall dark chestnut- to blackish-brown, uniformly 3–5 μ thick, coarsely and prominently tuberculate; pedicel colorless, fragile, appearing short.

On *Dipterostemon pauciflorus* (Torr.) Rydb. (*Brodiaea capitata pauciflora* Torr.), Tumamoc Hill, grounds of the Desert Botanical Laboratory, Tucson, Arizona, altitude 2,700 feet, February 26, 1914, *J. C. Arthur & F. D. Fromme 5801a.* This is the short-cycle form corresponding to the long-cycle species, *P. Carnegiana*

and *P. nodosa*. The teliospores are somewhat broader than in those species, and the general appearance is that of a more luxuriant growth. There is considerable resemblance to the short-cycle species *P. Lojkojana* Thüm., occurring in southeastern Europe on *Ornithogalum* and *Muscari*. The name has been chosen to indicate the only locality where the species has yet been found, and in compliment to the management of the Desert Botanical Laboratory, who so enthusiastically assisted Dr. Fromme and myself in our studies of the rust parasites of the vicinity. Tumamoc Hill is a rocky eminence having the sparse desert vegetation characteristic of the arid region about. In the early spring *Dipterostemon*, more usually called *Brodiaea*, is abundant over the whole area, up to the very doors of the Laboratory, its attractive flowers lending a special charm to the place. This species of rust and *P. Carnegiana* occur here and there in fair abundance, but are not general. The isolated manner of occurrence gave some countenance to the suggestion that mycelium hibernated in the bulbs. The problem of continuity through the long arid season is, however, one that will require considerable investigation. The interest in its solution is not confined to this species, or even to similar desert species, important as such knowledge would prove, but extends to species in other regions, including some of highly economic value.

Puccinia agnita sp. nov.

O. Pycnia chiefly epiphyllous, loosely grouped on discolored spots, punctiform, moderately conspicuous, subepidermal, angularly globoid in section, 65–115 μ in diameter; ostiolar filaments about 35 μ long.

III. Telia chiefly hypophyllous, irregularly grouped on pale spots 4–6 mm. across, round or oblong, 2–8 mm. across, at first covered by the membranous epidermis, soon naked, very pulverulent, light chestnut-brown; teliospores ellipsoid, 21–27 by 29–42 μ, rounded or obtuse at both ends, slightly or not constricted at septum; wall golden-brown, uniformly thin, 1.5–2 μ, inconspicuously verrucose, the pore in upper cell apical, in lower cell depressed two-thirds below septum, both pores with hyaline papilla; pedicel colorless, fragile, appearing short.

On *Claytonia megarrhiza* (A. Gray) Parry, Cumberland Mine, La Plata Mountains, Colorado, altitude 12,000 feet, July 15, 1898,

Baker, Earle & Tracy 1045. A short-cycle form corresponding to *Puccinia Claytoniata* (Schw.) Peck, but with the teliospores slightly broader, and the telia more definitely grouped.

Puccinia Fraseri sp. nov.

O. Pycnia not seen, probably wanting.

III. Telia hypophyllous, sometimes also on upper surface of leaf, evenly scattered over large areas, usually covering the whole leaf, round, 0.2–0.5 mm. across, strongly pulvinate, pale cinnamon-brown, usually whitish by germination, ruptured epidermis not visible; teliospores oblong, 15–21 by 37–45 μ, rounded or obtuse at both ends, slightly or not constricted at septum; wall very pale cinnamon-brown or nearly colorless, 1.5–2.5 μ thick, much thicker above, 5–9 μ, smooth; pedicel colorless, broad, 6–10 μ, once length of spore or less, the wall very thin but firm.

Urediniospores occur occasionally among the teliospores, obovoid, 16–21 by 23–29 μ; wall pale yellow or nearly colorless, 2–3 μ thick, sparsely echinulate, the pores indistinct, probably 3 or 4, equatorial.

On *Hieracium scabrum* Michx., Pictou, Nova Scotia, June 19, 1909, May 25 and June 22, 1910, *W. P. Fraser*, the last collection being taken as the type. It would be natural to infer that this short-cycle, leptoform species would be correlated with the common long-cycle form on the same and similar hosts. The common *Puccinia Hieracii* occurs in the same locality on *H. scabrum*, but its ellipsoid, verrucose teliospores indicate a different relationship. I take pleasure in dedicating the species to Mr. Fraser, who has furnished all the material for its study, and who is also entitled to much credit for his fine contributions to the knowledge of Uredinales and especially of the life history of a number of species.

Puccinia valida sp. nov.

II. Uredinia hypophyllous, scattered unevenly, irregularly rounded or somewhat elongated, 0.3–0.7 mm. across, early naked, pulverulent, cinnamon-brown, ruptured epidermis evident; urediniospores ellipsoid to broadly obovoid, 17–21 by 22–28 μ; wall cinnamon-brown, 1.5–2 μ thick, moderately echinulate, the pores 2, somewhat superequatorial.

III. Telia hypophyllous, scattered, moderately pulvinate, similar in appearance to the uredinia, but slightly darker; telio-

spores oblong or ovate-oblong, 13–19 by 28–39 μ, rounded at apex, somewhat narrowed below, slightly constricted at septum; wall cinnamon-brown, thin, 1 μ, thickened above, 4–7 μ, smooth; pedicel tinted, fragile, as long as the spore, or broken off much shorter.

On *Dioscorea convolvulacea* Schlecht & Cham., Jalapa, Mexico, October 2, 1898, *E. W. D. Holway 3115*. The host has recently been examined at the Gray Herbarium, where a phanerogamic specimen is deposited. The species differs from the nearly allied *D. grandifolia* Schlecht. in having much shorter leaves and longer staminate racemes. A number of species of rusts have been described on *Dioscorea*, and placed under different genera, from each of which the above form appears to be wholly distinct.

Puccinia Dondiae sp. nov.

II. Uredinia amphigenous; urediniospores broadly ellipsoid, 26–29 by 32–39 μ; wall cinnamon-brown, 1.5 μ thick, finely and closely echinulate, the pores 8, scattered.

III. Telia amphigenous, large, 0.4–0.7 mm. across, pulverulent, blackish-brown; teliospores ellipsoid, 32–39 by 42–51 μ, rounded at both ends, not constricted at septum; wall dark chocolate-brown, uniformly 4–5 μ thick, prominently and coarsely verrucose; pedicel nearly or quite as long as the spore, colorless or slightly tinted, more or less hygroscopic.

On *Dondia intermedia* (S. Wats.) Heller, San Diego, California, April 19, 1882, *Marcus E. Jones 3153*. The host of this collection has recently (January, 1915) been determined by Mr. Paul C. Standley of the United States National Herbarium. Although collected thirty-three years ago the species does not appear to have been found since.

Aecidium Farameae sp. nov.

O. Pycnia epiphyllous, in small groups 1–3 mm. across, or scattered over larger hypertrophied areas, becoming blackish-brown, subepidermal, deep-seated, 144–200 μ in diameter; ostiolar filaments short.

I. Aecia hypophyllous and caulicolous, in circular groups 2–5 mm. across, on discolored, slightly thickened spots, or scattered widely on much hyptertrophied and distorted petioles and shoots, low cylindric, small, 0.2–0.3 mm. in diameter; peridium erect, irregularly torn; aeciospores angularly globoid or oblong, 23–26 by 26–34 μ; wall colorless, 1.5 μ thick, much thicker above, 7–12 μ, moderately and evenly verrucose.

On *Faramea occidentalis* (L.) A. Rich., San Diego de los Baños, province of Pinar del Rio, Cuba, August 31 to September 3, 1910, *Britton, Earle & Gager 6855*. The deep-seated pycnia and aecia are especially characteristic of this species of rubiaceous rust. It may or may not be heteroecious.

Uredo fatiscens sp. nov.

II. Uredinia amphigenous, scattered or somewhat striate on yellowish or brownish spots, oblong, 0.3–0.5 mm. long, pulvinate, rather tardily naked, cinnamon-brown; urediniospores fusiform, 16–19 by 42–58 μ, narrowed at both ends, provided with a hyaline beak at apex, 5–7 μ long; wall golden-brown, thin, 1–1.5 μ, thickened above with a beak, the pores at or slightly above the equator, 2.

On *Carex Pseudo-Cyperus* L., Leland, Michigan, August 29, 1913, *J. C. Arthur*. This highly distinctive rust, whose slender, fusiform spores are very unlike those of any other cyperaceous rust known to the writer, was found in an open marsh close to the east shore of Lake Leelanau. Only a small infected area on two or three leaves was secured. The host was in fruit, and its determination has been made by Dr. Theo. Holm.

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